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NATIONAL DAM SAFETY PROGRAM. COLONIAL ACRES LAKE DAM (MO 30134)--ETC(U)
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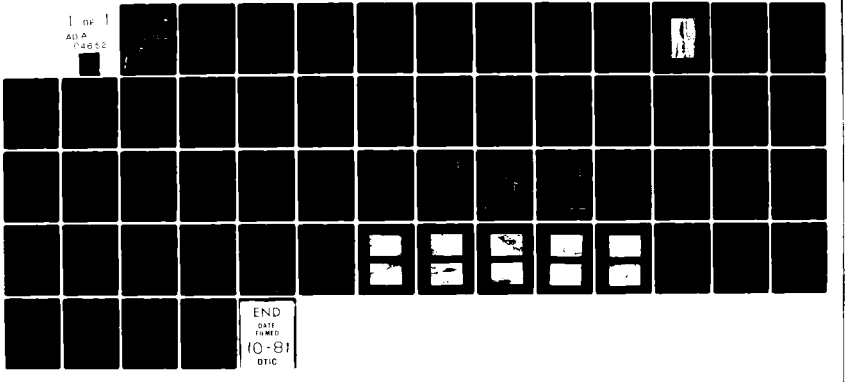

MISSISSIPPI - KASKASKIA - ST. LOUIS BASIN

COLONIAL ACRES LAKE DAM

PERRY COUNTY, MISSOURI

MO 30134

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

FEBRUARY 1980

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.	

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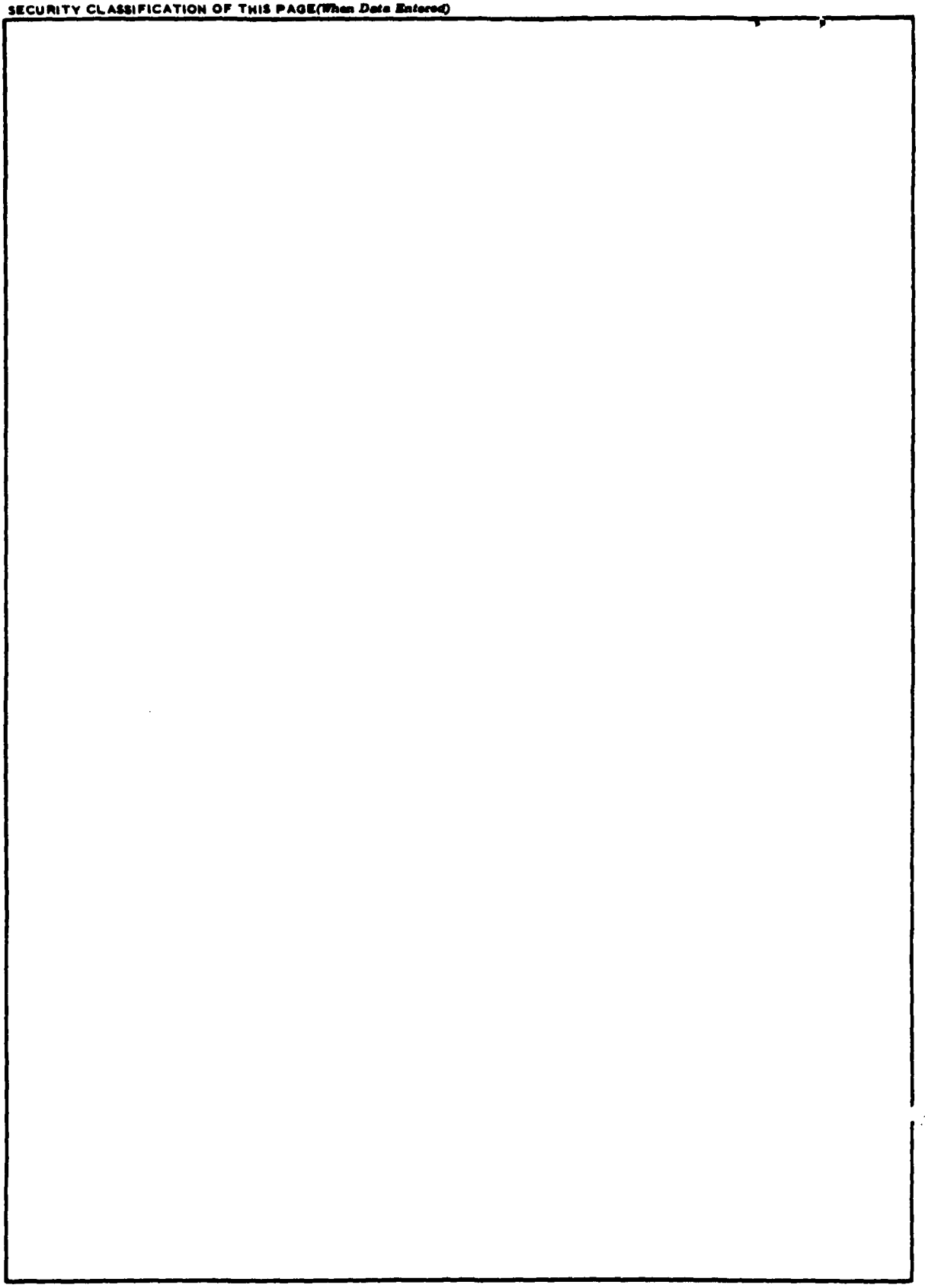

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COLONIAL ACRES LAKE DAM

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FOR: STATE OF MISSOURI

FEBRUARY 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Colonial Acres Lake Dam (Mo. 30134) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Colonial Acres Lake Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1. Spillway will not pass 50 percent of the Probable Maximum Flood.

2. Overtopping of the dam could result in failure of the dam.

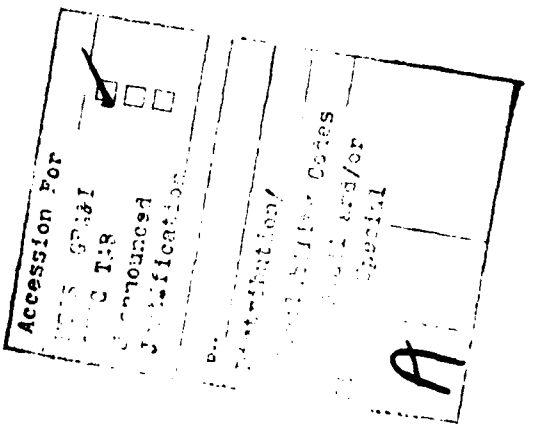
3. Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

31 MAR 1980
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

31 MAR 1980
Date



COLONIAL ACRES LAKE DAM - MISSOURI INVENTORY NO. 30134

PERRY COUNTY, MISSOURI

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

HORNER & SHIFRIN, INC.
5200 OAKLAND AVENUE
ST. LOUIS, MISSOURI 63110

FOR:

U.S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS

FEBRUARY 1980

HS-7925

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Colonial Acres Lake Dam
State Located:	Missouri
County Located:	Perry
Stream:	Tyler Branch Highland Creek
Date of Inspection:	27 September 1979

The Colonial Acres Lake Dam, was visually inspected by engineering personnel of Horner & Shifrin, Inc., Consulting Engineers, St. Louis, Missouri. The purpose of this inspection was to assess the general condition of the dam with respect to safety and, based upon this inspection and available data, determine if the dam poses a hazard to human life or property.

The following summarizes the findings of the visual inspection and the results of certain hydrologic/hydraulic investigations performed under the direction of the inspection team. Based on the visual inspection, the present general physical condition of the dam is considered to be satisfactory. The following deficiencies were noticed during the inspection and are considered to have an adverse effect on the overall safety and future operation of the dam:

1. Seepage as evidenced by wet, soft ground and pockets of standing water was observed in the vicinity of the downstream toe of slope junction with the right (looking downstream) abutment beginning about 15 feet below the dam crest. Uncontrolled seepage could develop into a piping condition that can lead to failure of the dam.

2. Small thorn trees are present on the upstream and downstream faces of the embankment near the center and right (looking downstream) abutment. According to a representative of the Owner, the trees have been sprayed, and judging by their condition appear to be either dead or dying. Although trees of this size are not considered to pose a potential piping hazard since the root growth is not extensively developed, it is recommended that the tree remains be removed in order to facilitate maintenance of the dam.

According to the criteria set forth in the recommended guidelines, the magnitude of the spillway design flood for the Colonial Acres Lake Dam, which is classified as small in size and of high hazard potential, is specified to be a minimum of one-half the Probable Maximum Flood (PMF). Considering the fact that Highway 51, four dwellings and four factory buildings are located within the possible flood damage zone, it is recommended that the spillway for this dam be designed for the PMF. The PMF is ordinarily accepted as the inflow design flood for dams where failure of the structure would increase the danger to human life. The Probable Maximum Flood (PMF) is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Results of a hydrologic/hydraulic analysis indicated that the existing spillways (principal plus emergency) are inadequate to pass lake outflow resulting from a storm of PMF magnitude. The principal spillway is adequate to pass lake outflow resulting from the 1 percent chance (100-year frequency) flood. Both spillways, principal plus emergency, are capable of passing lake outflow corresponding to about 23 percent of the PMF lake inflow. According to the St. Louis District Corps of Engineers, the length of the downstream damage zone, should failure of the dam occur, is estimated to be approximately three miles. Accordingly, within the possible damage zone are State Highway 51, four dwellings, and four factory buildings.

A review of available data did not disclose that seepage or stability analyses of this dam were performed. This is considered a deficiency and should be rectified.

It is recommended that the Owner take the necessary action in the near future to correct or control the deficiencies and safety defects reported herein.

Harold B. Lockett

Harold B. Lockett
P.E. Missouri E-4189

Albert B. Becker Jr.

Albert B. Becker, Jr.
P.E. Missouri E-9168

PHASE 1 INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

COLONIAL ACRES LAKE DAM - ID. NO. 30134

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PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

COLONIAL ACRES LAKE DAM - ID NO. 30134

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, dated 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, directed that a safety inspection of the Colonial Acres Lake Dam be made.

b. Purpose of Inspection. The purpose of this visual inspection was to make an assessment of the general condition of the dam with respect to safety and, based upon available data and this inspection, determine if the dam poses a hazard to human life or property.

c. Evaluation Criteria. This evaluation was performed in accordance with the "Phase I" investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams," Appendix D to "Report of the Chief of Engineers on the National Program of Dams," dated May 1975.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances. The Colonial Acres Lake Dam is an earthfill type embankment rising approximately 30 feet above the original stream bed. The embankment has an upstream slope (above the waterline) of 1v on 3h, a crest width of about 12 feet, and a downstream slope of 1v on 2h that increases to 1v on 2.5h at a point about 12 feet

below the top of the dam. The length of the dam including the spillway section is approximately 650 feet. Between abutments the alignment of the dam curves away from the lake. A plan and profile of the dam are shown on Plate 3 and a cross-section of the dam is shown on Plate 4. At normal pool elevation the reservoir impounded by the dam, occupies approximately 17 acres.

The principal spillway, a flat-bottomed trapezoidal section approximately 58 feet wide, passes through the dam at the left or west abutment. The spillway bends around the left end of the dam where it is confined by the abutment hillside on the west and by the riprap protected embankment on the east. Through the spillway crest area the invert consists primarily of an uneven rock surface. Below the crest section the channel invert, which drops steeply to the valley floor below the dam, is paved with concrete for about 90 feet before ending at a near vertical rock ledge approximately 5 feet high. A profile of the spillway channel is shown on Plate 4.

The emergency spillway, a shallow dish-shaped section approximately 20 feet wide, crosses the dam crest at the right or east abutment. The spillway outlet channel follows a course that parallels the main entrance road before reaching the downstream channel below the dam. An earthen berm serves to confine flow to the channel and protect the dam.

b. Location. The dam and lake are located on the Tyler Branch of Highland Creek, approximately 5 miles southwest of Perryville, Missouri, and just east of Highway 51, as shown on the Regional Vicinity Map, Plate 1. The dam is located in Section 3, Township 34 North, Range 10 East, in Perry County.

c. Size Classification. The size classification based on the height of the dam and storage capacity, is categorized as small. (Per Table 1, Recommended Guidelines for Safety Inspection of Dams.)

d. Hazard Classification. The Colonial Acres Lake Dam, according to the St. Louis District, Corps of Engineers, has a high hazard potential, meaning that if the dam should fail, there may be loss of life, serious damage to homes, extensive agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. The estimated flood damage zone, should failure of the dam occur, as determined by the St. Louis District, extends approximately three miles downstream of the dam. Within the possible damage zone are State Highway 51, four dwellings and four factory buildings.

e. Ownership. The lake and dam are owned by Colonial Acres, Incorporated, a Missouri corporation of which Mr. Oliver Hoehn is the President. Mr. Hoehn's address is: Highway 51 South, Perryville, Missouri 63775.

f. Purpose of Dam. The dam impounds water for irrigation and recreational use.

g. Design and Construction History. According to Mr. Hoehn, construction of the dam was started in 1964 and completed in 1965 and the builder of the dam was a Mr. Howard Davis, an excavating and grading contractor, from Perryville, Missouri. Mr. Hoehn reported that the dam was constructed without the benefit of formal engineering design data or plans. However, a Mr. Ricketts, formerly with the University of Missouri Extension School at Rolla, provided advice regarding the proportions of the spillways.

h. Normal Operational Procedure. The lake level is unregulated.

1.3 PERTINENT DATA

a. Drainage Area. The area tributary to the lake is essentially undeveloped. However, along State Highway 51 which runs

along the west side of the watershed, and contiguous to the lake there are several residences. An unpaved county road crosses the upstream end of the lake.The watershed above the dam amounts to approximately 352 acres. The watershed area is outlined on Plate 2.

b. Discharge at Damsite.

(1) Estimated known maximum flood at damsite ... 650 cfs*

(2) Spillway capacity (principal) ... 590 cfs (W.S. = Elev. 642.1)

(3) Spillway capacity (principal + emergency) ... 724 cfs (W.S. = Elev. 642.5)

c. Elevation (ft. above MSL). The following elevations were determined by survey and are based on topographic data shown on an advanced copy of the 1980 USGS Perryville, N.W., Missouri Quadrangle Map, 7.5 Minute Series.

(1) Top of dam ... 642.5 (min.)

(2) Normal pool (spillway crest) ... 639.0

(3) Streambed at centerline of dam ... 614±

(4) Maximum tailwater ... *Unknown*

d. Reservoir.

(1) Length at normal pool (Elev. 639.0) ... 1,400 ft.

(2) Length at maximum pool (Elev. 642.5) ... 1,900 ft

e. Storage.

(1) Normal pool ... 136 ac. ft.

(2) Top of dam (incremental) ... 64 ac. ft.

f. Reservoir Surface.

(1) Normal Pool ... 17 acres

(2) Top of dam (Incremental) ... 4 acres

*Based on an estimate of depth of flow as observed by Mr. Hoehn.

g. Dam.

(1) Type ... Earthfill, homogeneous*

(2) Length ... 624 ft.

(3) Height ... 29 ft.

(4) Top width ... 12 ft.

(5) Side slopes

a. Upstream ... 1v on 3h (above waterline)

b. Downstream ... 1v on 2h (above Elev. 630±)
1v on 2.5h (below Elev. 630±)

(6) Cutoff ... Clay core*

(7) Slope protection

a. Upstream ... Stone (dolomite) riprap

b. Downstream ... Grass

h. Principal Spillway.

(1) Type ... Uncontrolled, trapezoidal, broad-crested weir, rock section

(2) Crest ... Elevation 639.0

(3) Approach channel ... Lake

(4) Exit channel ... Trapezoidal section, concrete paved invert

i. Emergency Spillway.

(1) Type ... Uncontrolled, dish-shaped, broad-crested weir, earth section

(2) Crest ... Elevation 642.1

(3) Approach channel ... Lake

(4) Exit channel ... Earth cut, V-shaped section

j. Lake Drawdown Facility. ... None

*According to Mr. Hoehn

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

No engineering data relating to the design of the dam are known to exist.

2.2 CONSTRUCTION

No formal records were kept during construction of the dam. Mr. Hoehn reported that a core trench about 15 feet deep and approximately 12 feet wide, was excavated to rock along the centerline of the dam. The material used to backfill the trench and construct the embankment, a stoney red clay, was obtained from the area to be occupied by the lake. It was also reported that compaction of the fill was obtained using a tractor drawn flat roller and by the rubber-tired scraper used to haul the fill material.

2.3 OPERATION

The lake level is uncontrolled and governed by the crest elevation of the principal spillway located at the left abutment. An emergency spillway, with a crest elevation approximately 3.1 feet higher than the crest elevation of the principal spillway and about 0.4 feet lower than the top of the dam at its lowest point, is located at the right abutment. Mr. Hoehn reported that the dam has never been overtopped and that the highest lake level observed occurred sometime in 1969 when a 9-inch rainfall produced a depth of flow at the emergency spillway estimated to be about 3 inches.

2.4 EVALUATION

a. Availability. Engineering data for assessing the design of the dam and spillways were unavailable.

b. Adequacy. No data available. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Colonial Acres Lake Dam was made by Horner & Shifrin engineering personnel, H.B. Lockett, Civil Engineer and Hydrologist, T.K. Deddens, Geological Engineer, and A.B. Becker, Jr., Civil and Soils Engineer, on 27 September 1979. An examination of the dam site was also made by an engineering geologist, Jerry D. Higgins, a consultant retained by Horner & Shifrin for the purpose of assessing the area geology. Also examined at the time of the inspection, was the area below the dam within the potential flood damage zone. Photographs of the dam taken at the time of the inspection are included on Pages A-1 through A-5 of Appendix A. The locations of the inspection photographs are indicated on Plate 3.

b. Area Geology. The lake is located on the eastern flank of the Ozark Uplift on Ordovician-age sedimentary rock that dips gently eastward. At the dam site, the Powell formation is exposed at the surface. The Powell is a gray, finely crystalline, argillaceous dolomite and cherty dolomite. The dolomite is thin-to medium-bedded and weathers to a buff to brown color, with some thin-bedded dolomite weathering to white in color. The lower part of the formation contains several sandstone beds that are typically dark brown. The bedrock is covered by a thin residuum derived from insitu weathering. The residuum is a red clay and contains fragments of buff to brown colored dolomite and some fragments of chert. Bedrock exposures are limited to the spillway and stream channel below the dam.

The abutments are gently sloping, formed by bedrock with a thin cover of residuum. The abutment slopes appear stable with no severe erosion or seepage evident. The spillway, located in the left abutment, is cut into the bedrock and lined with concrete. At the spillway the dolomite is highly jointed; however, the joints are not open and not highly altered

by weathering. A spring is located on the downstream side of the right abutment, and reportedly is one of four springs located in the valley before construction of the dam. The remaining three are in the reservoir area. No severe erosion, seepage problems or adverse geologic conditions that would affect the performance of the reservoir or dam were evident at the site.

C. Dam. The visible portions of the upstream and downstream faces of the dam (see Photos 1 and 2) appeared to be in sound condition. Both faces have a substantial cover of fescue grass that at the time of the inspection was approximately 6 to 10 inches high. At the waterline the upstream face of the dam is protected from erosion by stone riprap that ranges in size up to 24 inches across. Numerous small thorn trees are present on both faces of the embankment, however, it was reported that the trees have been sprayed and appeared to be either dead or dying. No surface erosion of the embankment, cracking of the surface or misalignment of the dam crest was noticed.

Seepage was observed below the dam (see Photo 9) in the vicinity of the right abutment. Seepage was characterized by a marshy area with small pockets of standing water with an oil-like film on the surface (see Photo 10) and areas coated with a red gelatinous iron residue. The marshy area began approximately 15 feet below the dam crest and extended about 150 feet beyond the embankment to the valley floor. The seepage area had a maximum width of approximately 30 feet. Seepage flow was not distinguishable. Additional small amounts of seepage, less than 1 gpm, were noticed occurring from between the joints and fissures of the bedrock below the concrete pavement at the principal spillway channel.

The principal spillway (see Photos 3 and 4) appeared to be in sound condition. The concrete pavement covering the invert of the exit channel (see Photo 6) was in satisfactory condition without cracks, although the upstream end was partially undercut and some minor erosion of the subgrade was noticeable. The section of embankment that serves as the

spillway channel bank was well protected with stone riprap that ranged in size up to about 36 inches across. The lower section of the spillway exit channel also appeared to be in good condition. However, as previously indicated, some minor seepage was observed at the fissures and joints of the bedrock at this location. The spillway outlet channel that lies between the toe of the dam and the road crossing the channel (see Photo 6) at a point about 250 feet below the dam, was found to be in good condition, clear of obstructions and with only a few small willow trees along the right bank. Bedrock is exposed in several areas of the channel invert.

The emergency spillway also appeared to be in sound condition, although a barbed-wire type fence (see Photo 7) crosses the spillway crest. The spillway outlet channel (see Photo 8) was partially covered with brush and small trees.

d. Downstream Channel. The channel downstream of the dam is unimproved. A gravel surfaced road accessing the west side of the lake crosses the channel approximately 250 feet below the dam. The crossing, a concrete low-water bridge with a dry weather waterway opening approximately 2 feet high by 5 feet wide, was found to be in good condition. Tyler Branch joins Highland Creek approximately two miles below the dam.

e. Reservoir. The area adjoining the lake is well kept being mostly in pasture and native woodland. Several homes, including the Oliver Hoehn residence, are located adjacent to the lake. A gravel surfaced county road crosses the watershed at the south end of the lake. The amount of sediment within the lake could not be determined at the time of inspection, however, it is not believed to be significant. However, a minor amount of sediment was noticed within the lake just downstream of the county road.

3.2 EVALUATION

The deficiencies observed during this inspection and noted herein are not of major consequence. They are, however, of significant importance to warrant remedial action.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The spillways are uncontrolled. The water surface level is governed by precipitation runoff, evaporation, seepage, pumping for irrigation, and the capacity of the uncontrolled principal and emergency spillways.

4.2 MAINTENANCE OF DAM

According to Mr. Hoehn, President of Colonial Acres, Inc., the dam receives regular maintenance. Mr. Hoehn reported that the embankment is seeded and fertilized on an annual basis and that the thorn trees that exist on the dam have been sprayed on several occasions. Based upon the general condition of the dam it is apparent that the dam does receive regular attention. The embankment was well covered with grass that at the time of the inspection was approximately 6 to 10 inches high, and the thorn trees appeared to be either dead or dying.

4.3 MAINTENANCE OF OUTLET OPERATING FACILITIES

No outlet operating facilities exist at this dam. The pump used for irrigational purposes is portable and was not in operation at the time of the inspection.

4.4 DESCRIPTION OF ANY WARNING SYSTEMS IN EFFECT

The inspection did not reveal the existence of a dam warning system.

4.5 EVALUATION

A well maintained dam is considered beneficial to the safety of the dam. To facilitate maintenance of the dam, it is recommended that the remains of the thorn trees be removed from the embankment. It is also recommended that some means be provided to control the seepage condition that exists at the right abutment.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Hydraulic and hydrologic design data were not available.

b. Experience Data. The drainage area and lake surface area were developed from an advanced copy of the 1980 USGS Perryville N.W., Missouri, Quadrangle Map. The spillway and dam layout were developed from surveys made during the inspection.

c. Visual Observations.

(1) The principal spillway consists of a flat-bottomed, trapezoidal section, approximately 58 feet wide.

(2) The principal spillway is located within the embankment at the left (west) abutment.

(3) The principal spillway has a rock bottom through the crest section and a concrete paved invert that ends at a rock ledge through the exit section. The right (east) side of the spillway channel is lined with stone riprap, the left (west) side is cut into the weathered rock of the hillside.

(4) The spillway channel bends around the left side of the embankment dropping rapidly through the exit section and discharging onto bedrock exposed in the valley floor. Spillway releases not overtopping the adjacent embankment should not affect the integrity of the dam.

(5) The emergency spillway, a dish-shaped section, is located within the dam crest at the right (east) abutment.

(6) No lake drawdown facilities are provided.

d. Overtopping Potential. The spillways, principal and emergency, are inadequate to pass the probable maximum flood or 1/2 the probable maximum flood without overtopping the dam. They are adequate, however, to pass the 1 percent chance (100-year frequency) flood without overtopping the dam. The results of a dam overtopping analysis are as follows:

Ratio of PMF	Q-Peak Outflow (cfs)	Max. Lake W.S. Elev.	Max. Depth of Flow over Dam (Elev. 642.5)	Duration of Overtopping of Dam (Hrs.)
0.23	724	642.5	0.0	0.0
0.50	2,552	643.9	1.4	1.6
1.00	5,664	644.8	2.3	5.3
100 Yr.-Flood	538	642.0	0.0	0.0

Elevation 642.5 was found to be the lowest point in the dam crest. The flow safely passing the spillway just prior to overtopping amounts to 724 cfs, which is equivalent to about 23 percent of the probable maximum flood inflow. This outflow is greater than the outflow of the 1 percent chance (100-year frequency) flood.

During peak flow of the probable maximum flood, the greatest depth of flow over the dam crest will be 2.3 feet with the overflow extending across the entire length of the dam.

e. Evaluation. Experience with embankments constructed of similar material (gravelly, red clay) to that used to construct this dam have shown evidence that the material under certain conditions, such as high velocity flow, can be very erodible. Such a condition exists during the PMF when large lake outflow, accompanied by high flow velocities occurs.

For the PMF condition where the depth of flow over the dam crest, a maximum of 2.3 feet, and the duration of flow over the dam, [illegible].3 hours, are appreciable, damage by erosion to the crest and downstream face of the dam is expected. The extent of these damages is not predictable, however there is a probability that they could result in failure of the dam.

f. <u>References</u>. Procedures and data for determining the probable maximum flood, the 100-year frequency flood, and the discharge rating curve for flow over the spillway and the dam crest are presented on Pages B-1 and B-2 of the Appendix. A listing of the HEC-1 (Dam Safety Version) input data is shown on Pages B-3 and B-4 of the Appendix. A copy of the computer output table entitled "Summary of Dam Safety Analysis" is presented on Page [illegible] and the inflow and outflow hydrographs for the probable maximum flood are shown on Plate [illegible] of the Appendix. Area-stage curves for the reservoir are shown on Plate [illegible] and a spillway discharge rating curve is presented on Plate 6.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations which adversely affect the structural stability of the dam are discussed in Section 3, paragraph 3.1c.

b. Design and Construction Data. No design or construction data relating to the structural stability of the dam are known to exist. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Operating Records. No appurtenant structures or facilities requiring operation exist at this dam. According to Mr. Hoehn, no records are kept of the lake level, spillway discharge, dam settlement, or seepage.

d. Post Construction Changes. Mr. Hoehn also reported that no post construction changes have been made or have occurred which would affect the structural stability of the dam.

e. Seismic Stability. The dam is located within a Zone II seismic probability area, however, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. A hydraulic analysis indicated that the spillways (principal plus emergency) are capable of passing lake outflow of about 724 cfs without the level of the lake exceeding the low point in the top of the dam. A hydrologic analysis of the lake watershed area, as discussed in Section 5, paragraph 5.1d, indicates that for storm runoff of probable maximum flood magnitude, the lake outflow would be on the order of 5,664 cfs, and that for the 1 percent chance (100-year frequency) flood, the lake outflow would be about 538 cfs.

The only item noticed during the inspection that could adversely effect the safety of the dam was the seepage that is occurring in the vicinity of the right abutment.

Seepage and stability analyses of the dam were not available for review and therefore no judgment could be made with respect to the structural stability of the dam.

b. Adequacy of Information. Due to lack of design and construction data, the assessments reported herein were based on external conditions as determined during the visual inspection. The assessments of the hydrology of the watershed and capacity of the spillway were based on a hydrologic/hydraulic study as indicated in Section 5. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. The items concerning the safety of the dam noted in Paragraph 7.1a and the remedial measures recommended in paragraph 7.2 should be accomplished within a reasonable time.

d. Necessity for Phase II. Based on the results of the Phase I Inspection, a Phase II investigation is not recommended.

e. Seismic Stability. The dam is located within a Zone II seismic probability area, however, an earthquake of the magnitude predicted is not expected to produce a hazardous condition to the dam, provided that static stability conditions are satisfactory and conventional safety margins exist.

7.2 REMEDIAL MEASURES

a. Recommendations. The following actions are recommended:

(1) Based upon criteria set forth in the recommended guidelines, alterations to the design of the dam should be made in order to pass lake outflow resulting from a storm of probable maximum flood magnitude.

(2) Obtain the necessary soil data and perform dam stability and seepage analyses in order to determine the structural stability of the dam for all operational conditions. Seepage and stability analyses should be performed by a qualified professional engineer experienced in the design and construction of dams.

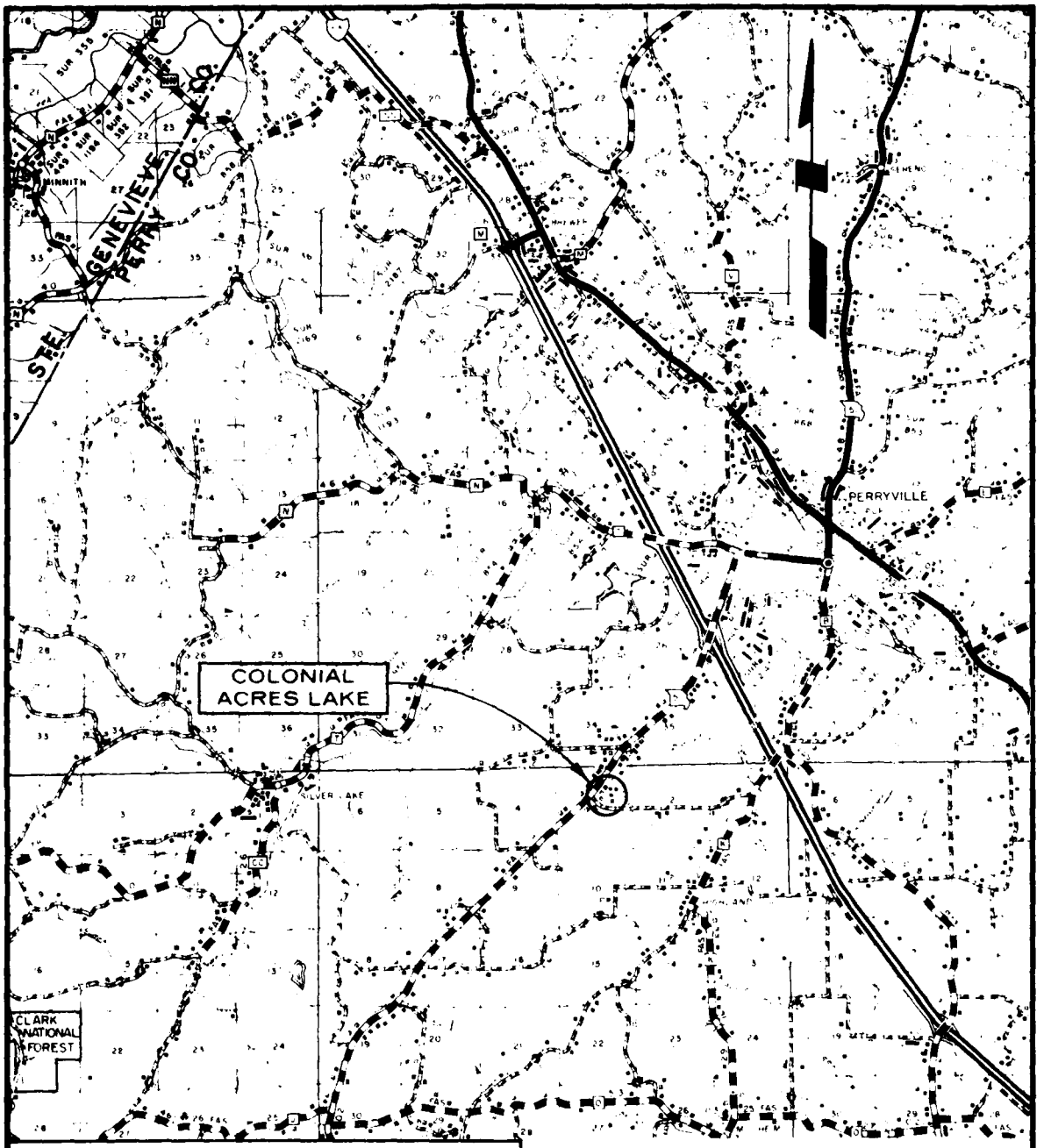
b. Operations and Maintenance (O & M) Procedures. The following O & M Procedures are recommended:

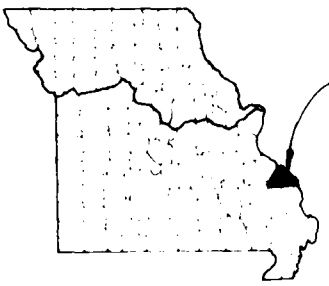
(1) In order to facilitate maintenance of the dam, it is recommended that the remains of thorn trees be removed from the embankment.

(2) Provide some means of preventing piping (progressive internal erosion) due to seepage occurring in the vicinity of the right abutment. A piping conditions can result in failure of the dam.

(3) Continue to provide maintenance of all areas of the dam and spillways on a regularly scheduled basis in order to insure that these areas remain in satisfactory condition.

(4) A detailed inspection of the dam should be instituted on a regular basis by an engineer experienced in the design and construction of earthen dams. It is also recommended for future reference, that records be kept of all inspections made and remedial measures taken.





LOCATION MAP

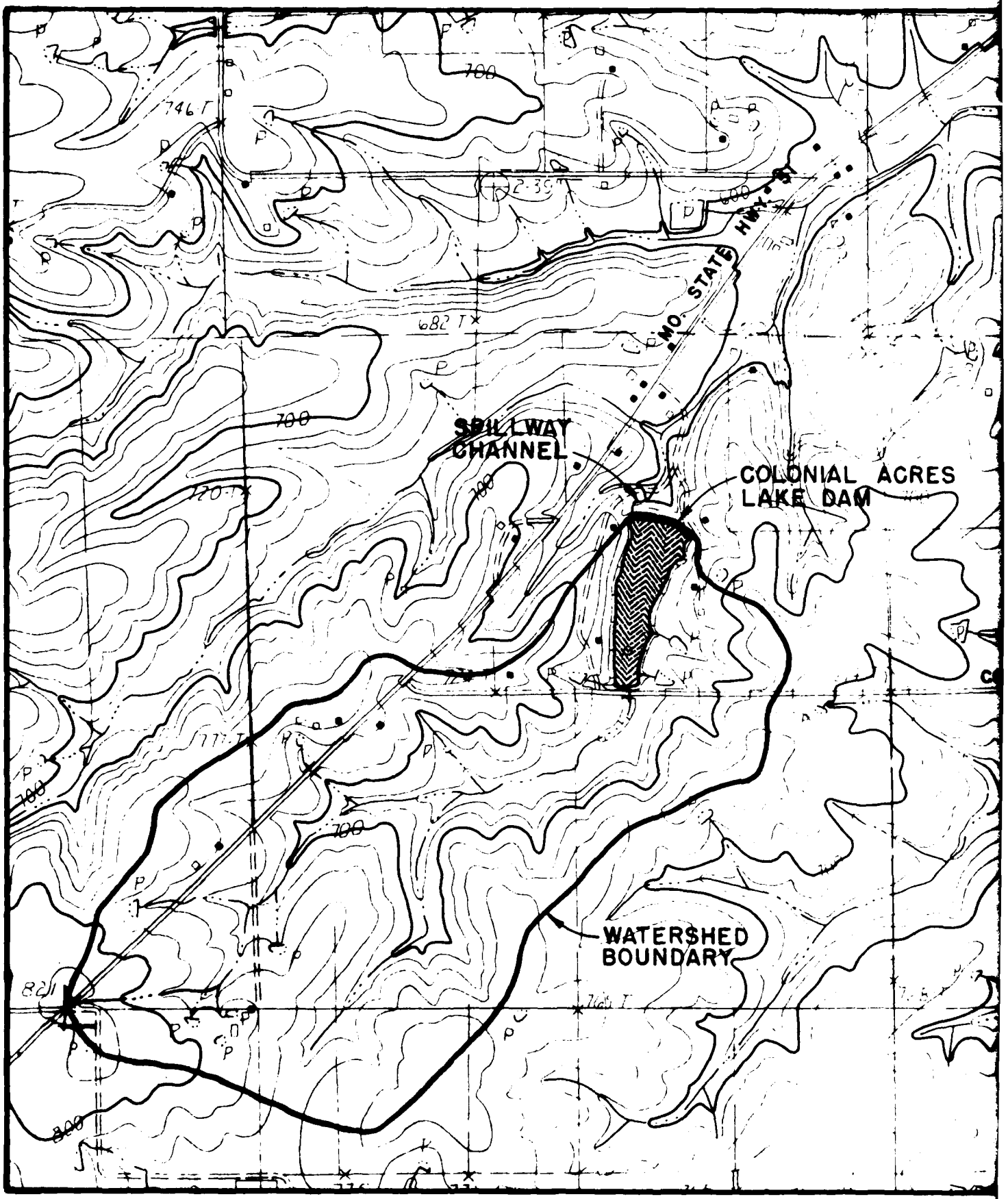
COLONIAL ACRES LAKE

1 0 1 2 3 4

SCALE (MILES)

REGIONAL VICINITY MAP

PLATE 1


SPILLWAY CHANNEL
COLONIAL ACRES LAKE DAM
MO. STATE HWY.
WATERSHED BOUNDARY

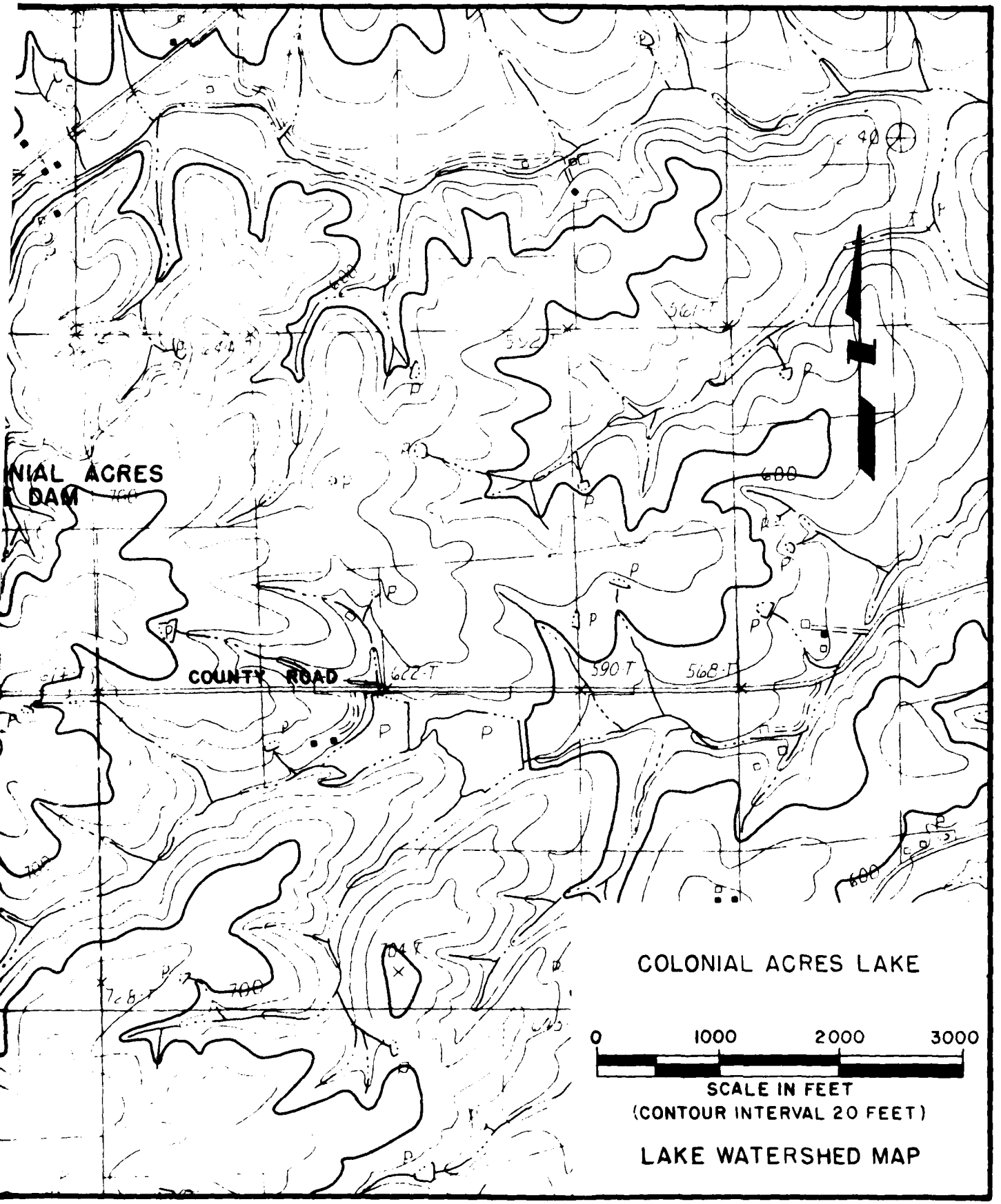
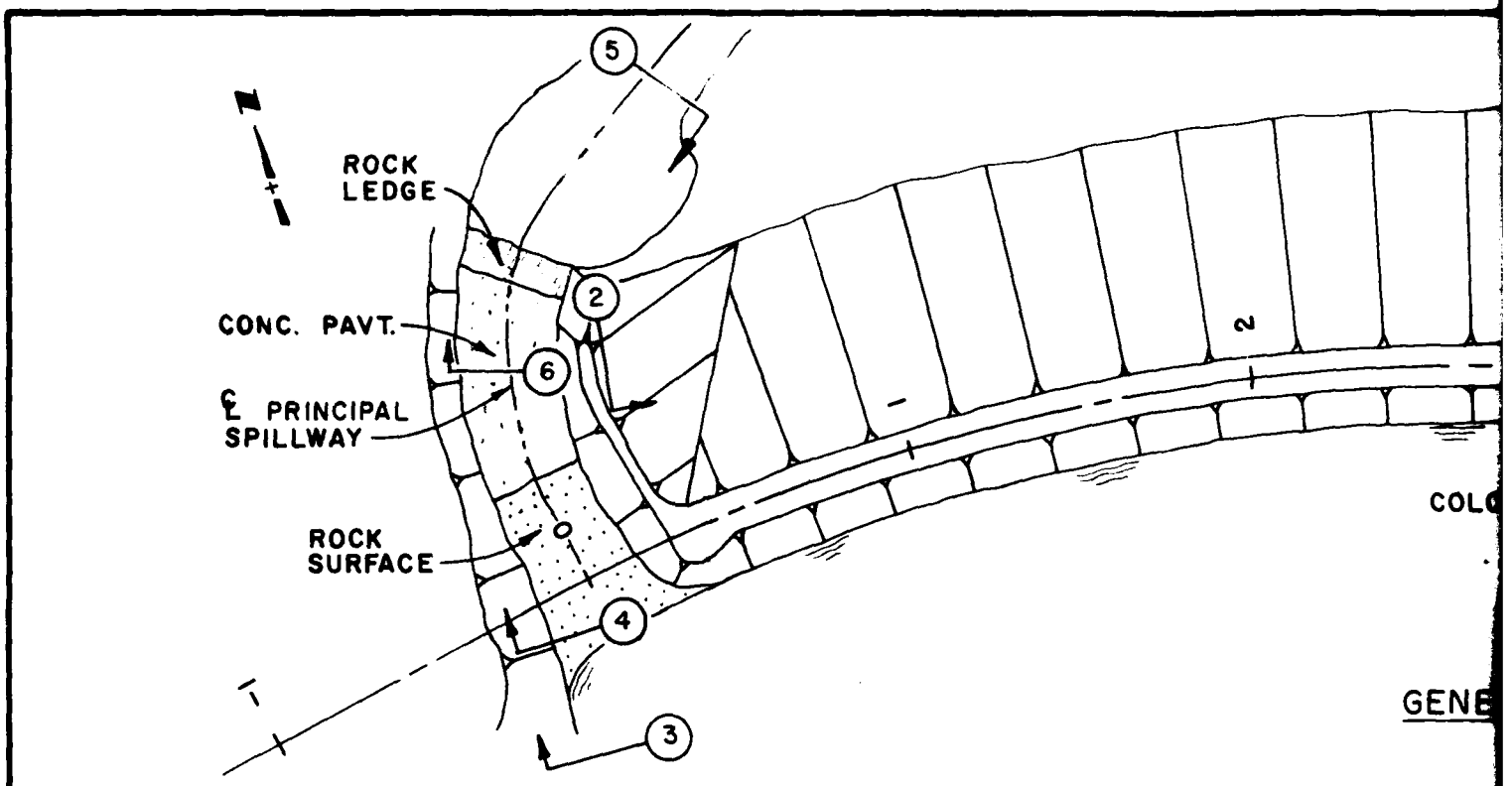
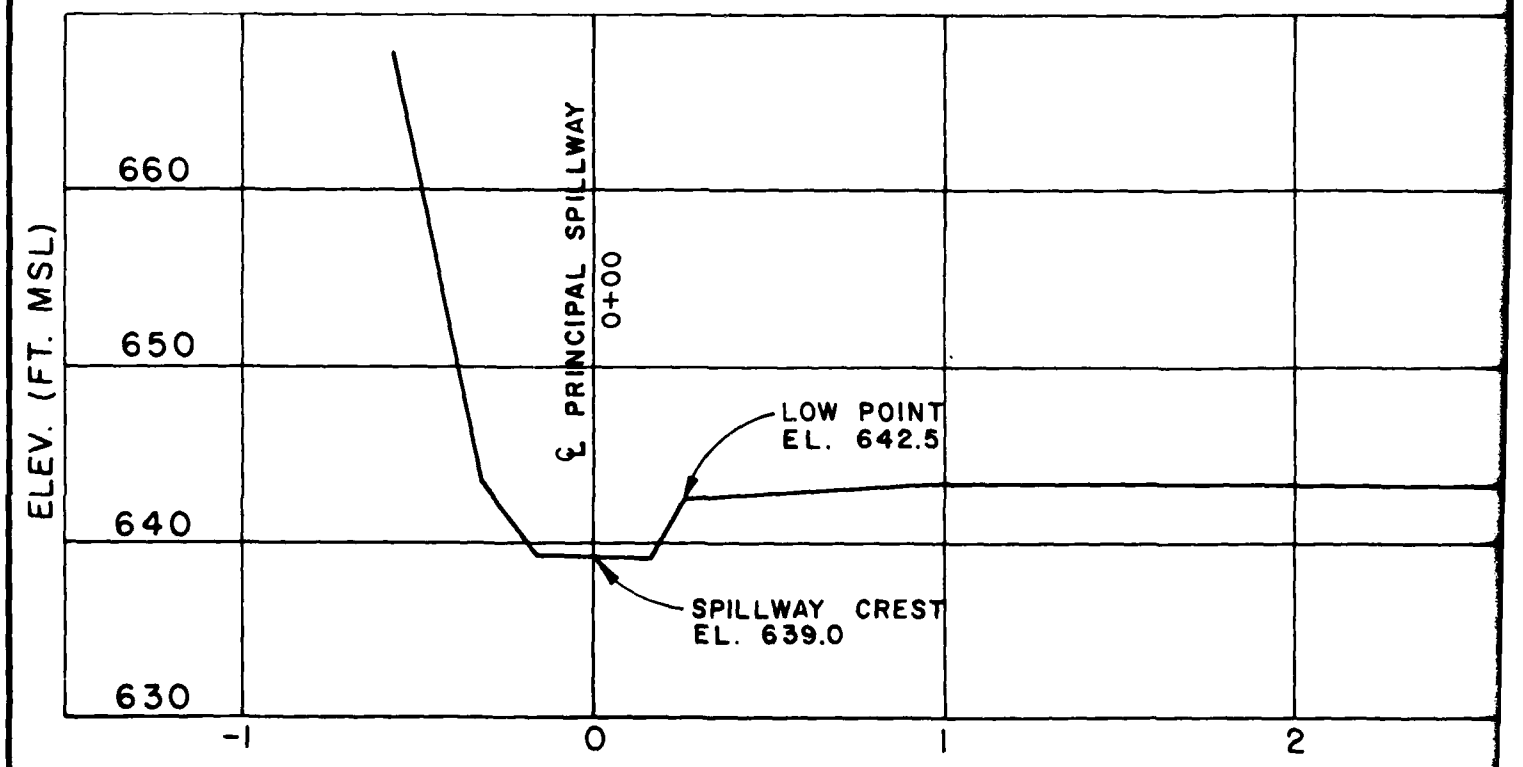
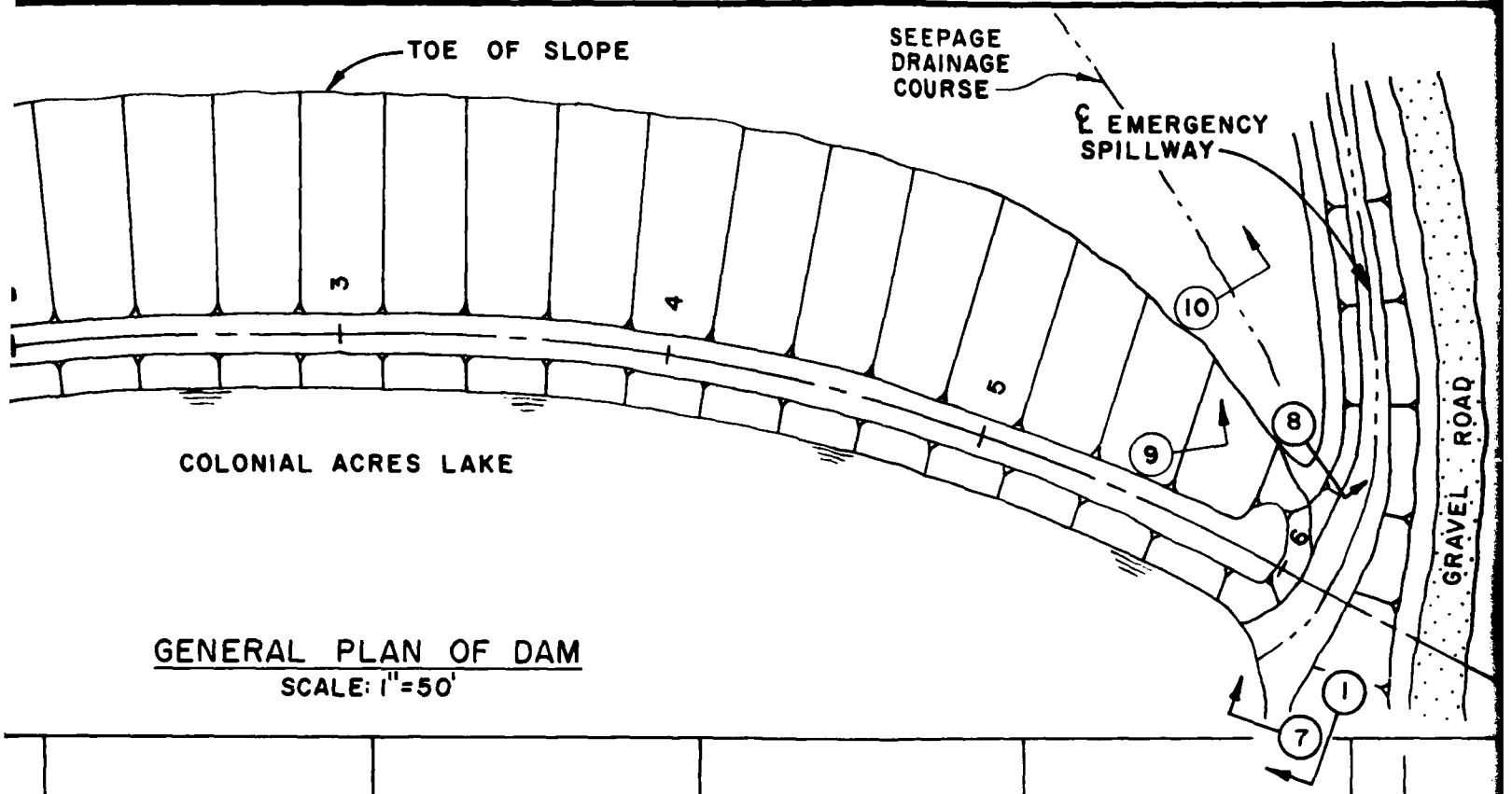

NIAL ACRES
DAM
COUNTY ROAD
622 T
590 T
568 T
561 T
600
700
704 T
768
COLONIAL ACRES LAKE
0
1000
2000
3000
SCALE IN FEET
(CONTOUR INTERVAL 20 FEET)
LAKE WATERSHED MAP

PLATE 2

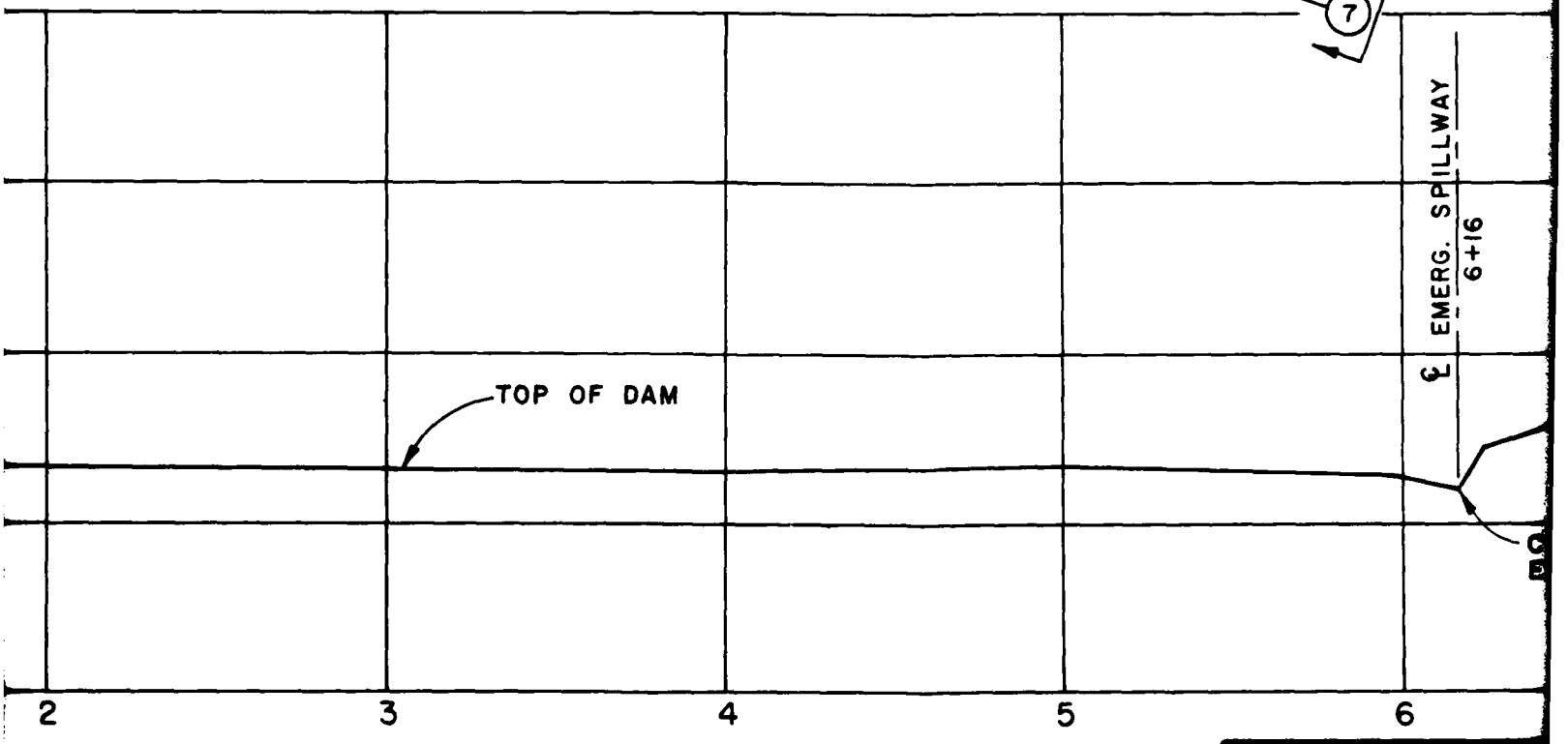




6
PHOTO LOCATION & KEY
(SEE APPENDIX A)



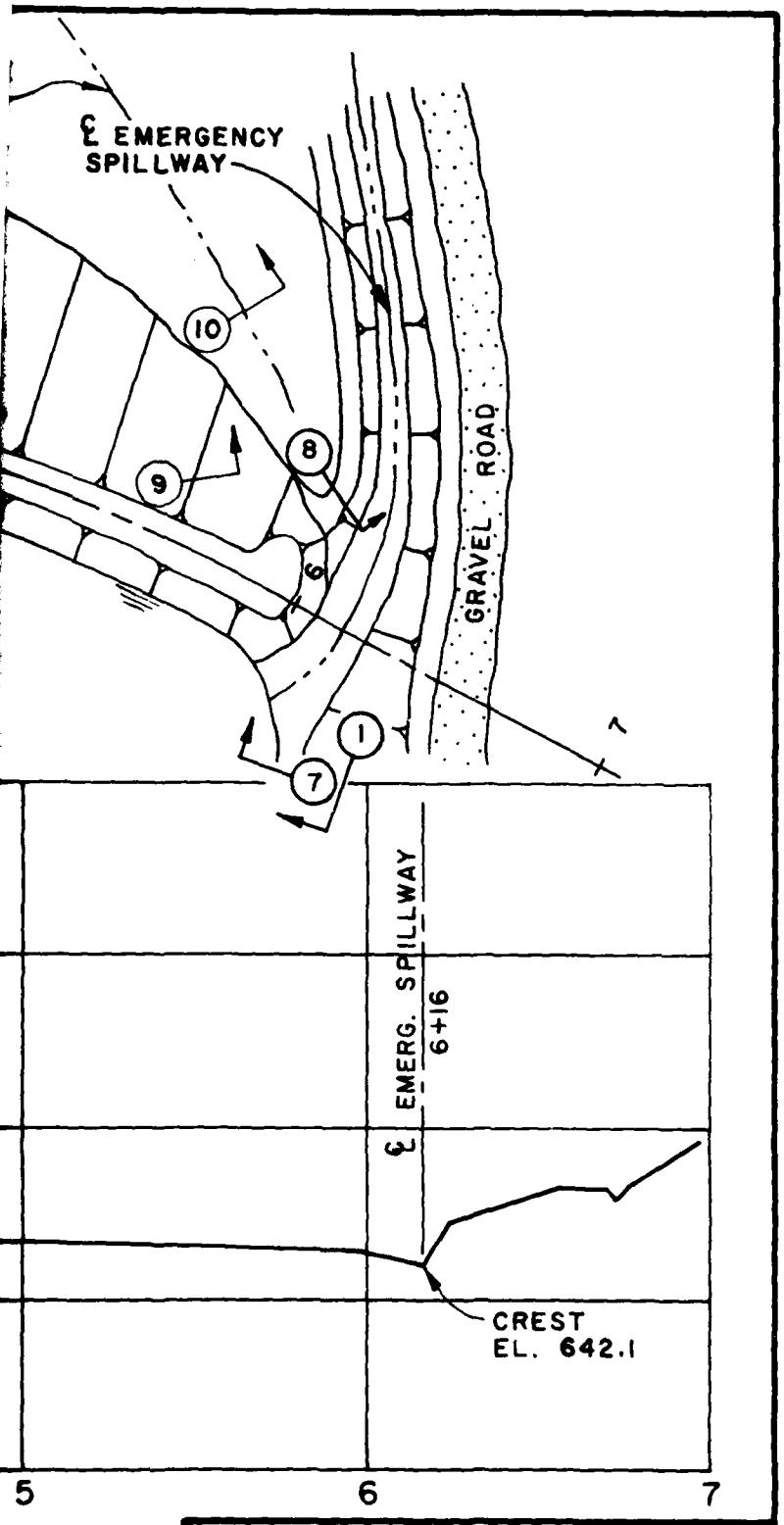
GENERAL PLAN OF DAM
SCALE: 1"=50'



PROFILE DAM CREST
SCALES: 1"=10'V., 1"=50'H.

COLONIAL AC
DAM PLAN

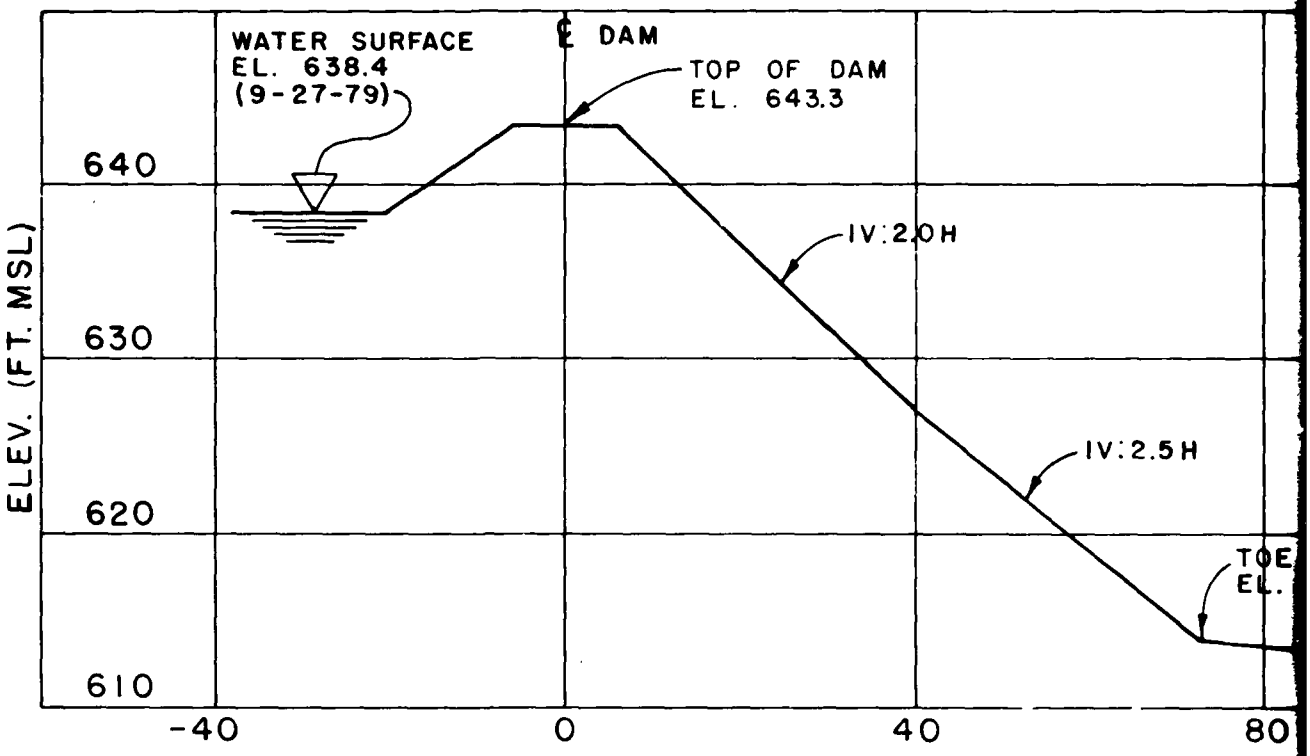
Horner & Shifrin, Inc



COLONIAL ACRES LAKE
DAM PLAN & PROFILE

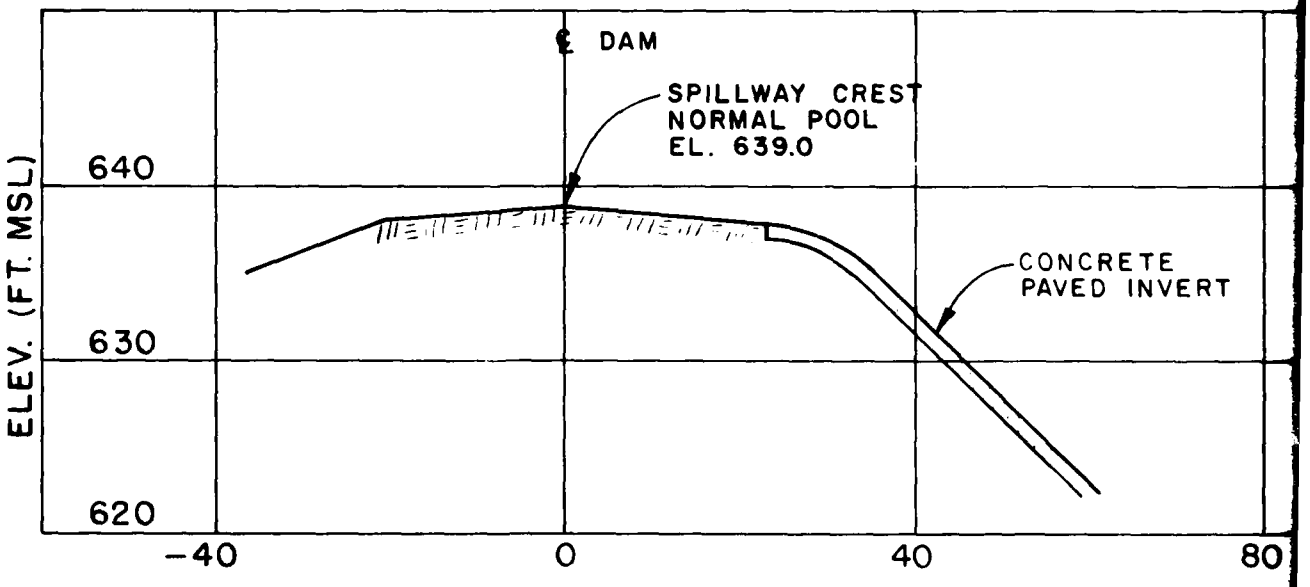
Horner & Shifrin, Inc. Oct. 1979

PLATE 3



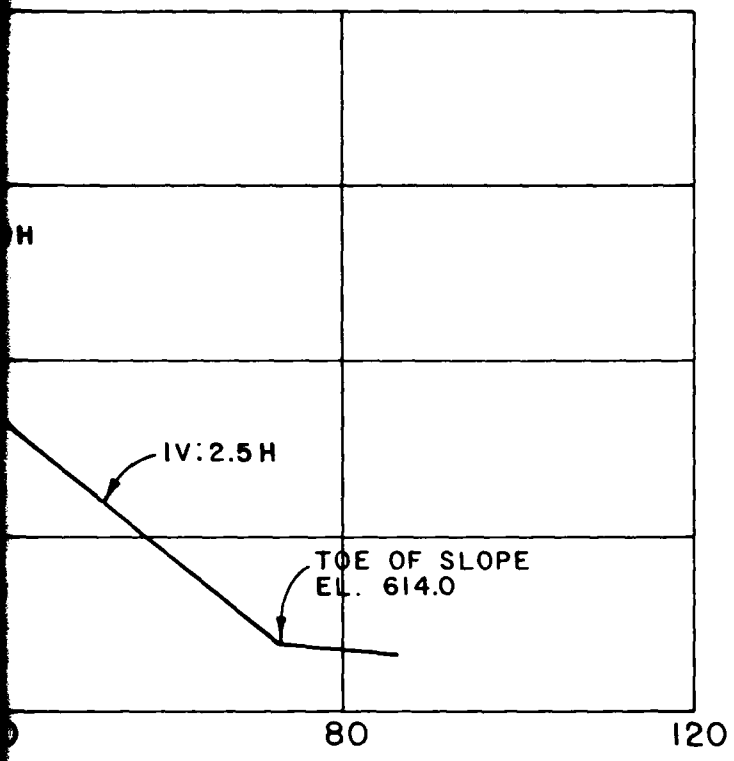
DAM CROSS SECTION STA. 2+00

SCALES: 1"=10' V., 1"=20' H.

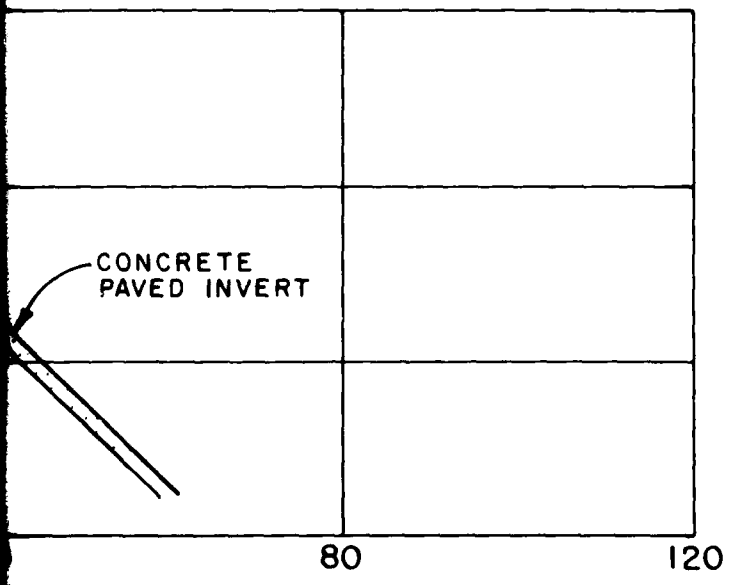


PROFILE SPILLWAY ℄

SCALES: 1"=10' V., 1"=20' H.



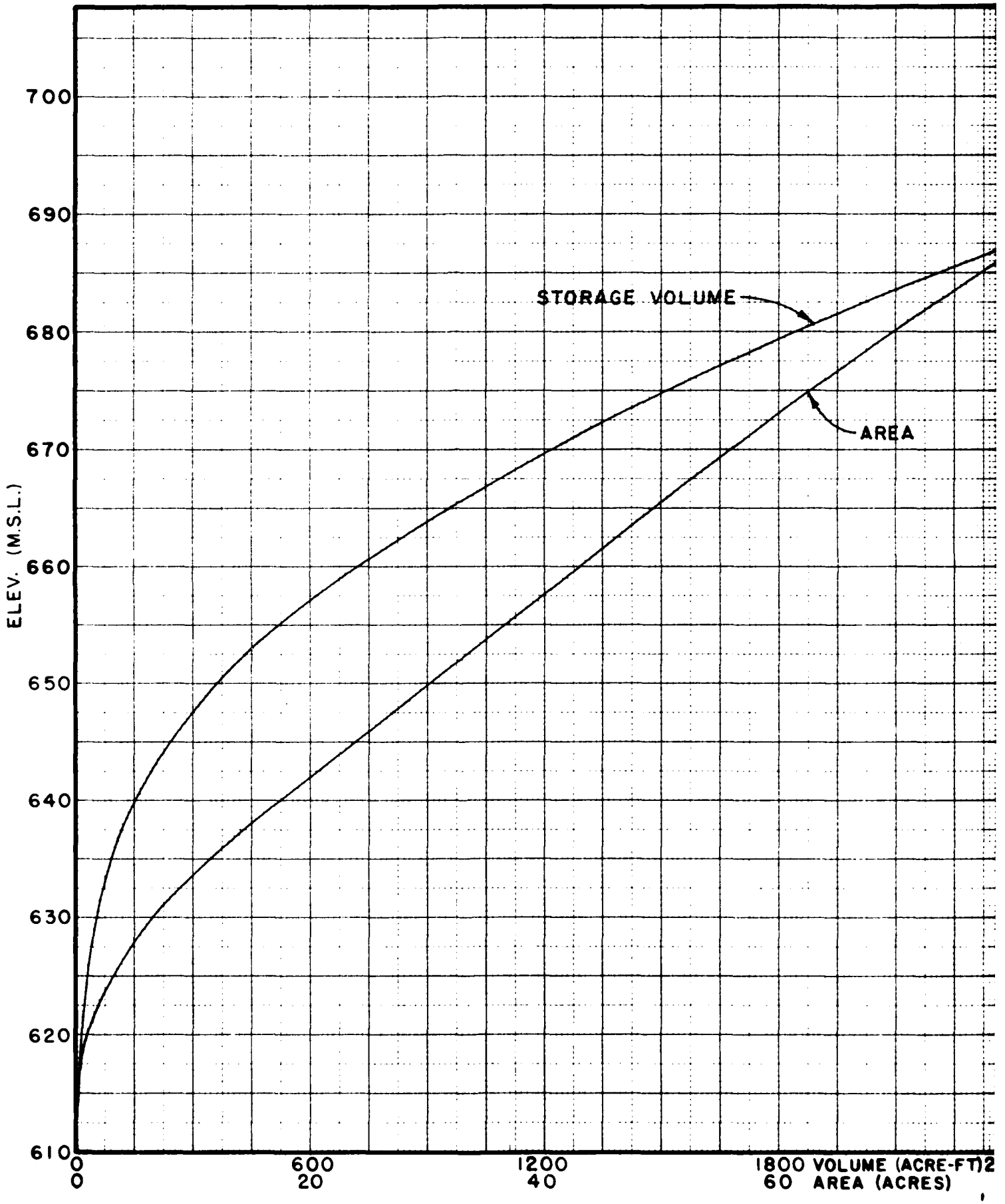
STA. 2+00
20' H.

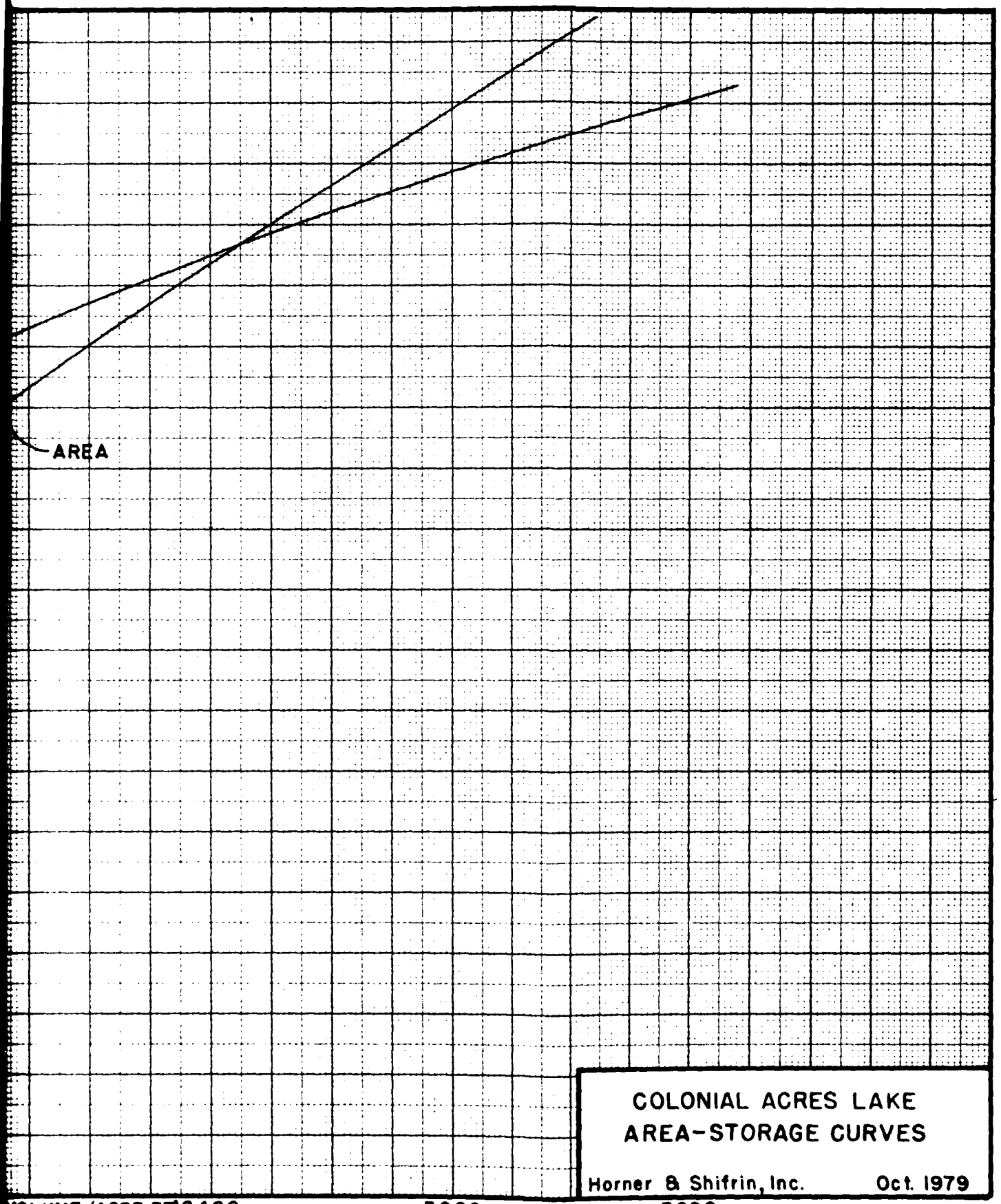


AY ℄
20' H.

COLONIAL ACRES LAKE
DAM CROSS SECTION &
SPILLWAY PROFILE
Horner & Shifrin, Inc. Oct. 1979

PLATE 4


700
690
680
670
660
650
640
630
620
610
ELEV. (M.S.L.)
STORAGE VOLUME
AREA
0
0
600
20
1200
40
1800 VOLUME (ACRE-FT)2
60 AREA (ACRES)

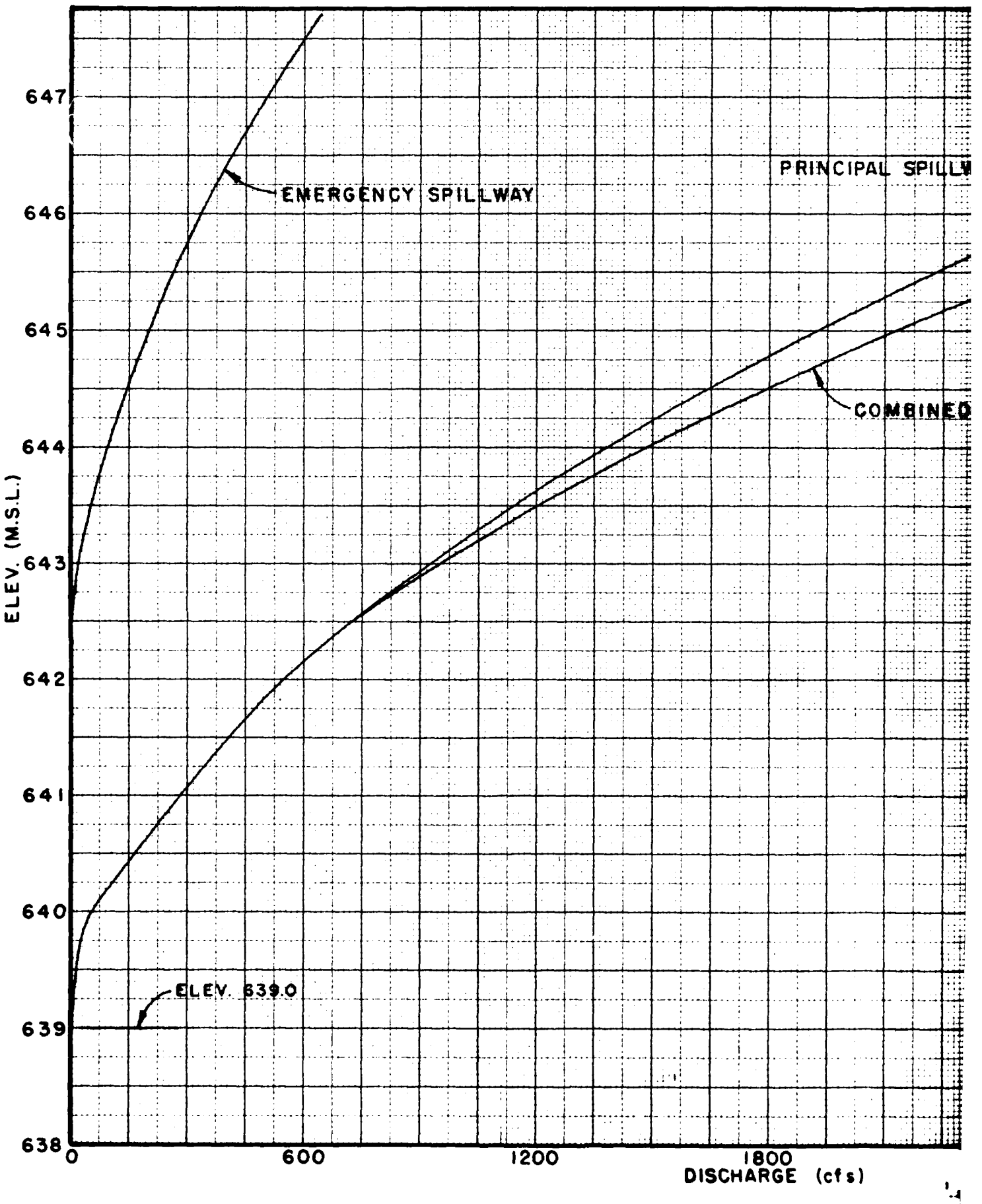


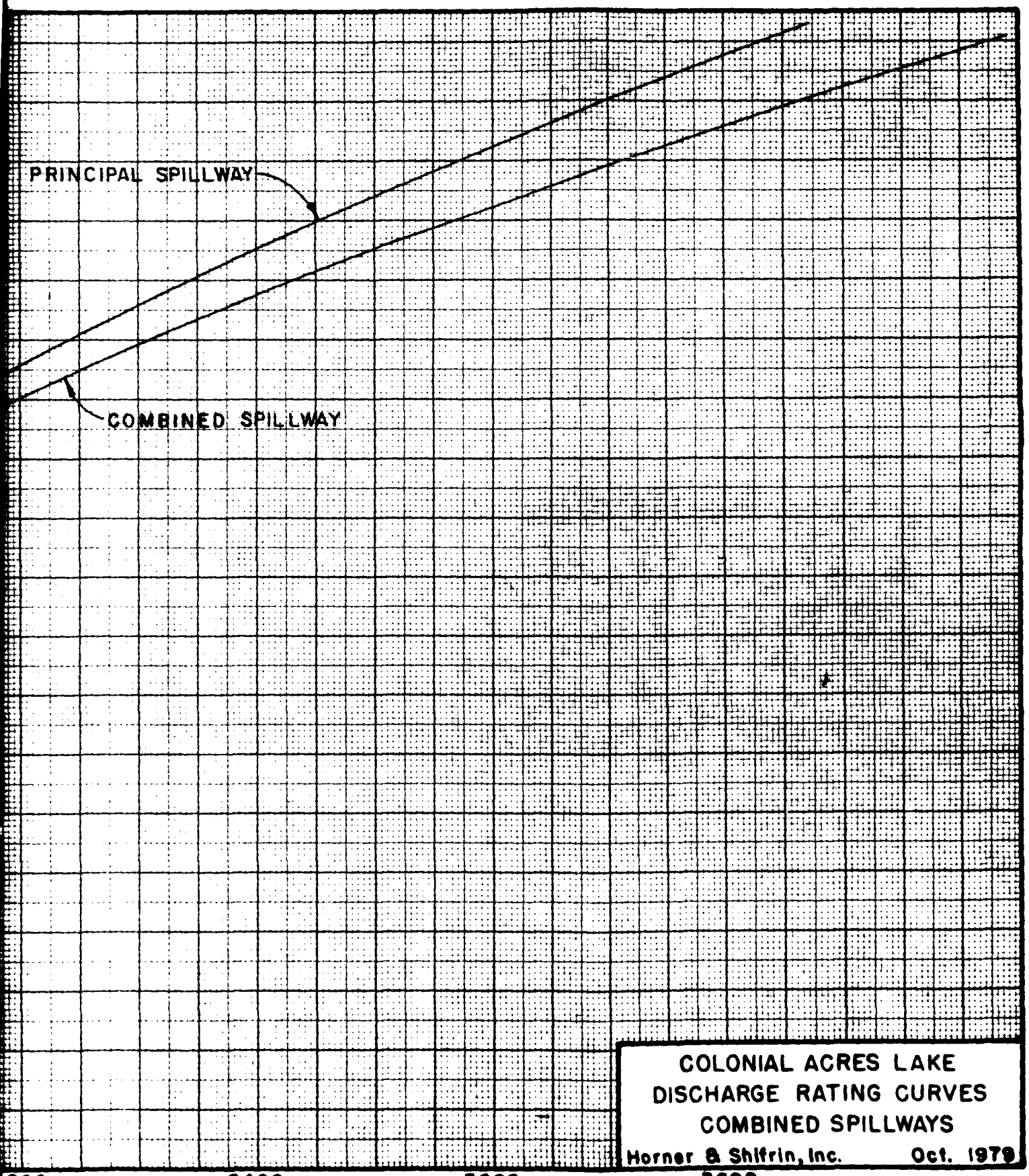
COLONIAL ACRES LAKE
AREA-STORAGE CURVES

Horner & Shifrin, Inc. Oct. 1979

VOLUME (ACRE-FT) 2400 3000 3600
AREA (ACRES) 80 100 120

PLATE 5


647
646
645
644
643
642
641
640
639
638
ELEV. (M.S.L.)
EMERGENCY SPILLWAY
PRINCIPAL SPILLW
COMBINED
ELEV. 639.0
0
600
1200
1800
DISCHARGE (cfs)



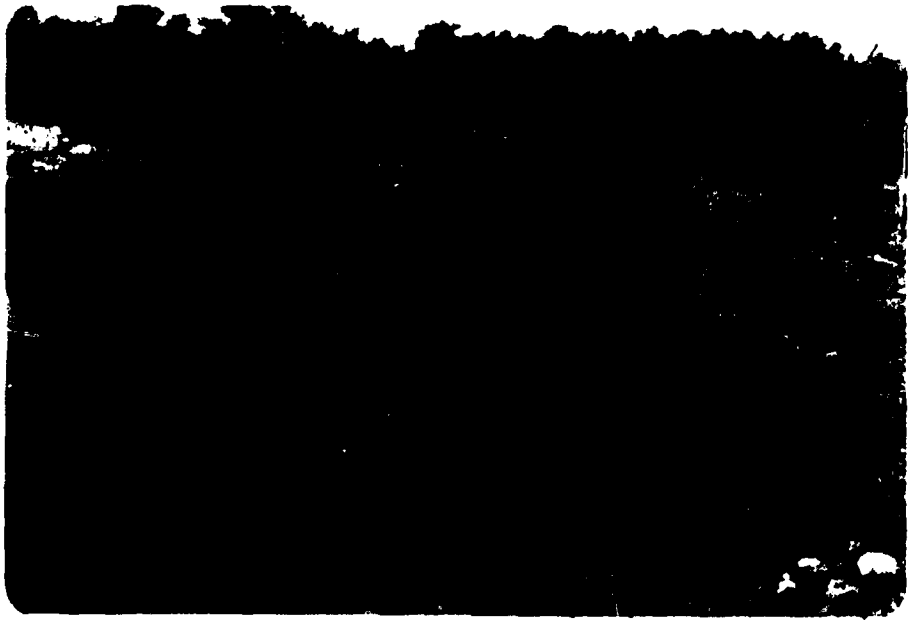
COLONIAL ACRES LAKE
DISCHARGE RATING CURVES
COMBINED SPILLWAYS
Horner & Shifrin, Inc. Oct. 1979

800 2400 3000 3600
ARGE (cfs)

PLATE 6

APPENDIX A

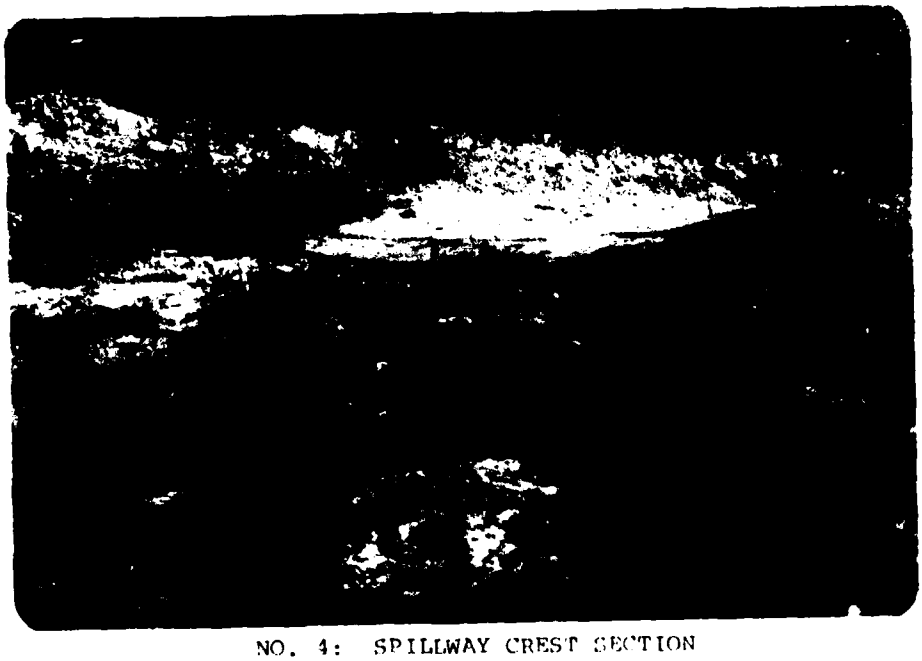
INSPECTION PHOTOGRAPHS



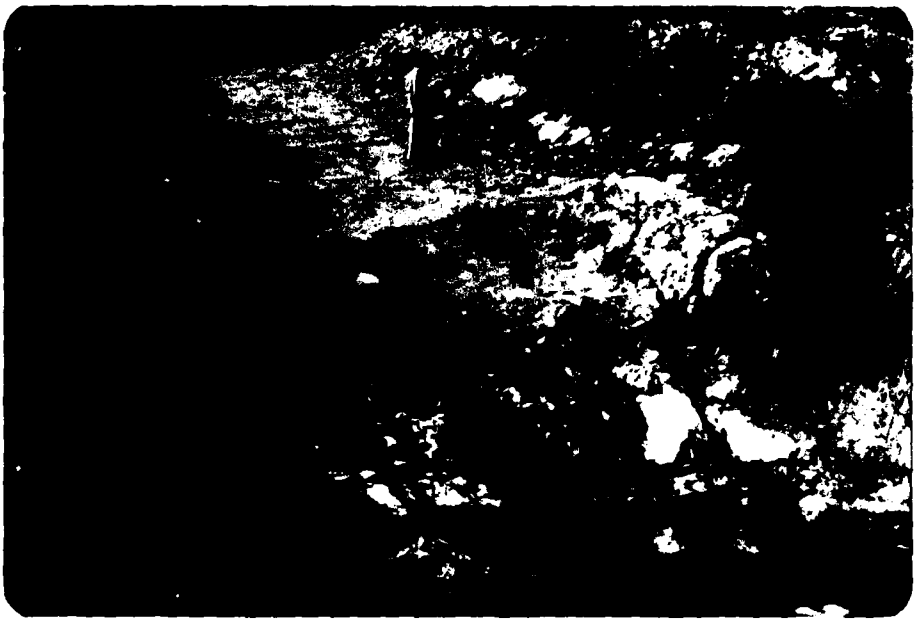
NO. 1: UPSTREAM FACE OF DAM

NO. 2: DOWNSTREAM FACE OF DAM

NO. 3: SPILLWAY APPROACH AND CREST



NO. 4: SPILLWAY CREST SECTION

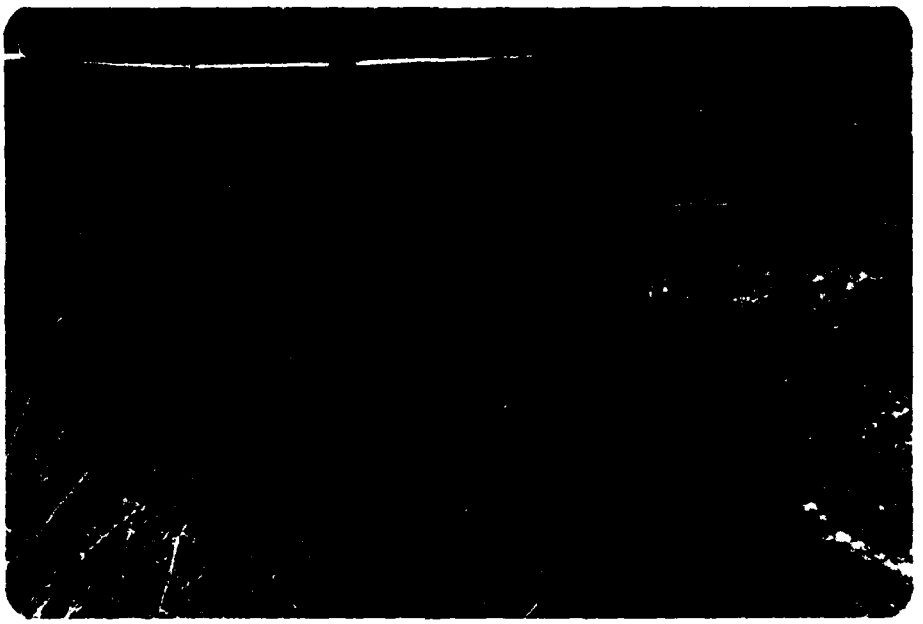


NO. 5: SPILLWAY EXIT SECTION

NO. 6: SPILLWAY [illegible]

NO. 7: EMERGENCY SPILLWAY CREST

NO. 8: EMERGENCY SPILLWAY OUTLET CHANNEL



No. 9: SEEPAGE AREA BELOW RIGHT ABUTMENT

NO. 10: SEEPAGE IN AREA BELOW RIGHT ABUTMENT

APPENDIX B

HYDROLOGIC AND HYDRAULIC ANALYSIS

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

1. The HEC-1 Dam Safety Version (July 1978, Modified 26 February 1979) program was used to develop inflow and outflow hydrographs and dam overtopping analyses, with hydrologic inputs as follows:

a. Probable maximum precipitation (200 sq. mile, 24-hour value equals 27.0 inches) from Hydrometeorological Report No. 33. The precipitation data used in the analysis of the 1 percent (100-year flood) was provided by the St. Louis District, Corps of Engineers.

b. Drainage area = 0.55 square miles = 352 acres.

c. SCS parameters:

Lag time = 0.245 hours
Soil Group C = 100 percent
Soil type CN = 75 (AMC II), 88 (AMC III)
Lag Time = 0.60 Tc (SCS Method)
Time of Concentration (Tc) = $(\frac{11.9L^3}{H})^{0.385}$

Where; T_c = Travel time of water from hydraulically most distant point to point of interest, hours

L = Length of longest watercourse, miles

H = Elevation difference, feet.

2. The principal and emergency spillway sections consist respectively of broad-crested, trapezoidal and dish-shaped sections for which conventional weir formulas do not apply.

Spillway release rates for these sections were determined as follows:

a. Spillway crest section properties (area, a and top width, t) were computed for various depths, d.

b. It was assumed that flow over the spillway crest would occur at critical depth. Flow at critical depth was computed as $Q_c=(\frac{a^3}{t}g)^{0.5}$ for the various depth, d. Corresponding velocities (v_c) and velocity heads (H_{vc}) were determined using conventional formulas.

c. Static lake levels corresponding to the various values passing over the spillway were computed as critical depths plus critical velocity head ($d_c + H_{vc}$), and the relationship between lake level and spillway discharge was thus obtained. The procedure neglects the minor insignificant friction losses across the length of the spillway.

d. The discharges for the principal and emergency spillways for equal elevations were summated for entry on the Y4 and Y5 cards.

3. The profile of the dam crest between the principal spillway and emergency spillway is irregular and flow over the dam crest cannot be determined by conventional weir formulas. Crest length and elevation data for the dam crest proper were entered into the HEC-1 Program on the $L and the $V cards. The program computes internally the flow over the dam crest and adds this flow to the flow over the principal and emergency spillways as entered on the Y4 and Y5 cards.

```
A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF COLONIAL ACRES LAKE DAM
A3       RATIOS OF PMF ROUTED THROUGH RESERVOIR
B      288        0        5                                                        0
B1       5
J        1        5        1
J1     .22      .23      .24      .50      1.0
K        0   INFLOW                                            1
K1       INFLOW HYDROGRAPH
M        1        2     0.55                        1.0                             1
P        0     27.0      102      120      130
T                                                          -1      -88
W2              0.245
X     -1.0     -.10      2.0
K        1      DAM                                            1
K1       RESERVOIR ROUTING BY MODIFIED PULS
Y                                    1        1
Y1       1                                                136       -1
Y4   639.0    639.6    640.4    641.1    641.8    642.5    643.1    644.1    645.9    647.1
Y5       0       38      148      284      484      725     1360     1802     2798     3884
$A       0     16.7     17.4     41.2     69.8    101.0
$E614.57    639.0      640      660      680      700
$S   639.0
$D   642.5
$L      16       42       90      369      580      580      580      580
$V   642.7    642.9    643.1    643.3    643.5    643.9    644.3    648.9
K       99
```

```
A1       ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF COLONIAL ACRES LAKE DAM
A3       100YR FLOOD ROUTED THROUGH RESERVOIR
B     288       0       5                                                       0
B1      5
J       1       1       1
J1    1.0     .23     .24     .50     1.0
K       0   INFLOW                                      1
K1       INFLOW HYDROGRAPH
M       0       2    0.55                     1.0                               1
O     288
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .013    .013    .013    .013    .013    .013
O1   .013    .013    .013    .013    .024    .024    .024    .024    .024    .024
O1   .024    .024    .024    .024    .024    .024    .024    .024    .024    .024
O1   .024    .024    .031    .031    .031    .031    .031    .031    .049    .049
O1   .049    .049    .049    .049    .138    .138    .139    .262    .262    .544
O1   .813    .378    .262    .139    .138    .138    .049    .049    .049    .049
O1   .049    .049    .031    .031    .031    .031    .031    .031    .024    .024
O1   .024    .024    .024    .024    .024    .024    .024    .024    .024    .024
O1   .024    .024    .024    .024    .024    .024    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
O1   .007    .007    .007    .007    .007    .007    .007    .007
T                                                      -1     -74
W2          0.245
X    -1.0   -.10      2.0
K       1    DAM                                        1
K1       RESERVOIR ROUTING BY MODIFIED PULS
Y                                 1       1
Y1      1                                             136      -1
Y4  639.0   639.6   640.4   641.1   641.8   642.5   643.1   644.5   645.9   647.1
Y5      0      38     146     289     484     725    1360    1802    2778    3694
$A      0    16.7    17.4    41.3    59.8   101.0
$E614.57   639.0     640     660     680     700
$$  639.0
$D  642.5
$L     16      42      99     369     580     580     580     580
$V  642.7   642.9   643.1   643.3   643.5   643.9   644.9   648.9
```

SUMMARY OF DAM SAFETY ANALYSIS

RATIOS OF PMF

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	639.00	639.00	642.50
STORAGE	136.	136.	200.
OUTFLOW	0.	0.	725.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.22	642.39	0.00	197.	688.	0.00	16.08	0.00
.23	642.50	0.00	199.	724.	0.00	16.08	0.00
.24	642.58	.08	201.	811.	.25	16.08	0.00
.50	643.87	1.37	234.	2552.	1.58	15.92	0.00
1.00	644.82	2.32	248.	5664.	5.33	15.83	0.00

SUMMARY OF DAM SAFETY ANALYSIS

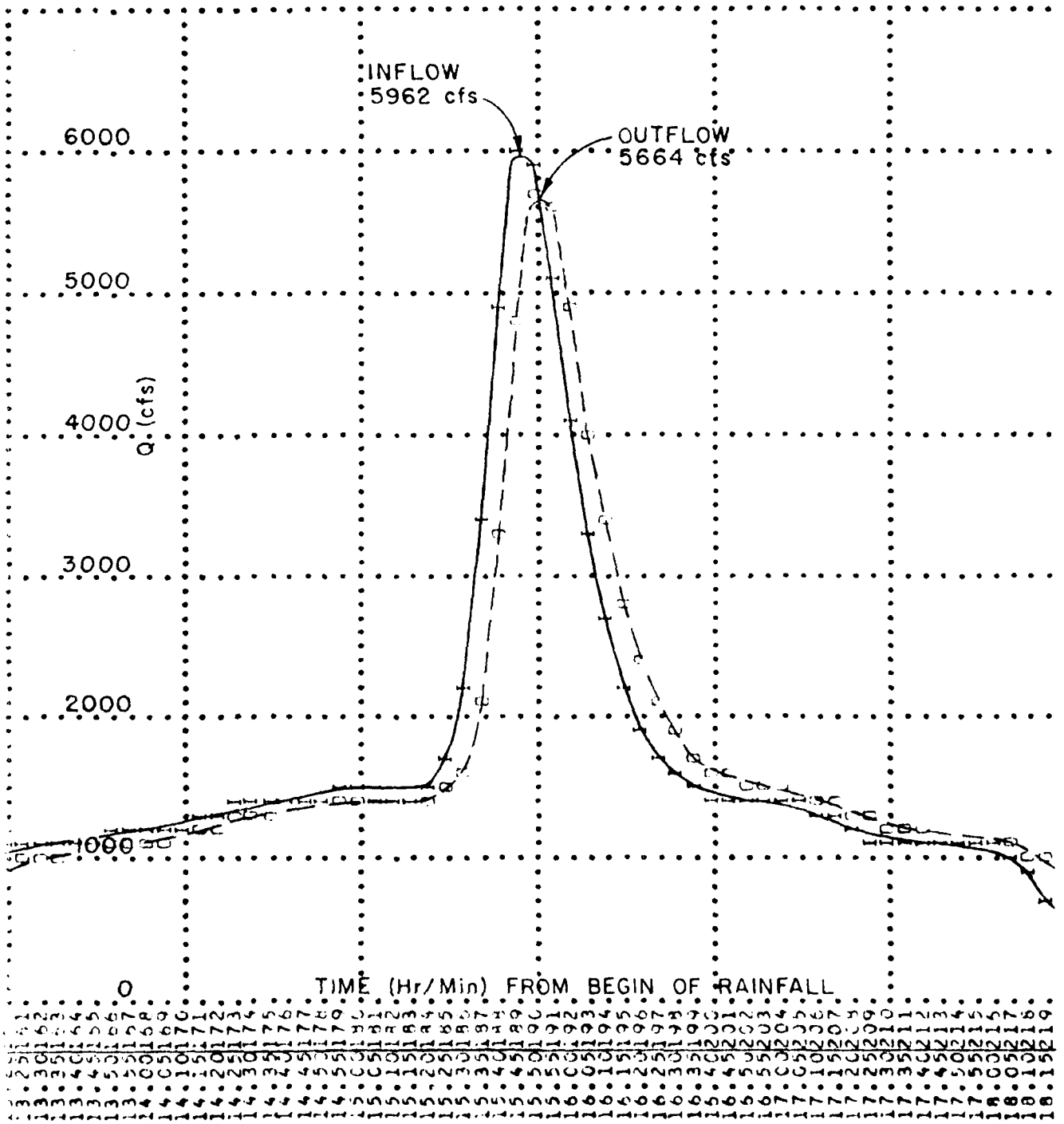
100 YR. FLOOD

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	639.00	639.00	642.50
STORAGE	136.	136.	200.
OUTFLOW	0.	0.	725.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	641.98	0.00	189.	538.	0.00	15.75	0.00

COLONIAL ACRES LAKE
PMF INFLOW & OUTFLOW
HYDROGRAPHS

Horner & Shifrin, Inc. Oct. 1979




DATE
IL ME